

Amendments to the Claims

The listing of claims will replace all prior versions, and listings of claims in the application.

Claim 1 (currently amended): An injection molding apparatus, comprising:

a manifold having, ~~said manifold having an inlet and defining a runner, wherein said runner is downstream from said inlet, and said runner is upstream from a manifold outlet;~~

a nozzle, ~~said nozzle~~ defining a nozzle melt channel, ~~wherein said nozzle melt channel is downstream from said manifold outlet, wherein said nozzle includes a nozzle body, a nozzle tip, and a seal piece, and a heater thermally connected to said nozzle body, wherein one of said seal piece and said nozzle tip is removably connected to~~ removable from said nozzle body and wherein said nozzle tip defines a portion of said nozzle melt channel;

a mold block defining a ~~mold cavity and a gate into said mold cavity, wherein said gate is downstream from said nozzle melt channel, wherein said gate includes a gate sealing surface, said mold block having at least one cooling channel therein, wherein said seal piece engages said mold block, and so that said seal piece and said mold block are capable of inhibiting melt leakage therebetween, wherein a chamber is defined between~~ by said mold block, said nozzle tip and said seal piece~~[[,]]~~ and wherein said nozzle tip has sufficient surface area in said chamber ~~such that said nozzle tip is capable of~~ maintaining to maintain melt in said chamber in a substantially molten state; and

a valve pin, ~~wherein said valve pin is movable into and out of said gate such that~~

~~said valve pin controls melt flow through said gate and into said mold cavity, wherein~~
~~said valve pin has a bottom end and~~ having a valve pin sealing surface ~~proximate said~~
~~bottom end, said valve pin sealing surface being engageable with said gate sealing~~
surface;

said valve pin having a first guidance and alignment structure upstream from said
valve pin sealing surface including a first guide surface and a first alignment surface,
wherein said first guide surface has a cross-sectional diameter that decreases gradually in
a downstream direction, and wherein said first alignment surface is generally cylindrical
and said first guide surface is positioned immediately downstream from said first
alignment surface; and

said mold block having a second guidance and alignment structure upstream from
said gate sealing surface including a second guide surface and a second alignment
surface, wherein said second guide surface has a diameter that decreases gradually in a
downstream direction, and wherein said second alignment surface is generally cylindrical
and said second guide surface is positioned immediately upstream from said second
alignment surface,

wherein, during movement of said valve pin towards said gate, said second guide
surface ~~is is capable of engaging~~ engages said first guide surface, ~~and sliding~~ said first
alignment surface slides into alignment with said second alignment surface, ~~and said~~
~~second~~ first alignment surface ~~is capable of sliding~~ slides along said ~~first~~ second
alignment surface and ~~positioning~~ said valve pin sealing surface is positioned in
alignment with said gate sealing surface ~~during movement of said valve pin towards said~~
~~gate~~.

Claim 2 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said first guidance and alignment structure includes a relief channel that extends along at least a portion of said first guide surface and at least a portion of said first alignment surface.

Claim 3 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said second guidance and alignment structure includes a relief channel that extends along at least a portion of said second guide surface and at least a portion of said second alignment surface.

Claim 4 (currently amended): An injection molding apparatus as claimed in claim 1, wherein:

said valve pin has a third guidance and alignment structure including a third guide surface and a third alignment surface upstream from said first guidance and alignment structure, wherein said third guide surface has a cross-sectional diameter that decreases gradually in a downstream direction, and wherein said third alignment surface is generally cylindrical and said third guide surface is positioned immediately downstream from said third alignment surface and is upstream from said first alignment surface; and

said nozzle tip has a fourth guidance and alignment structure including a fourth guide surface and a fourth alignment surface, wherein said fourth guide surface has a diameter that decreases gradually in a downstream direction, and wherein said fourth alignment surface is generally cylindrical and said fourth guide surface is positioned immediately upstream from said fourth alignment surface and said fourth alignment

surface is upstream from said second guide surface,

wherein, during movement of said valve pin towards said gate, said fourth guide surface ~~is capable of engaging~~ engages said third guide surface, ~~and sliding said~~ said third alignment surface slides into alignment with said fourth alignment surface, ~~and said~~ ~~fourth~~ third alignment surface ~~is capable of sliding~~ slides along said ~~third~~ fourth alignment surface and ~~generally positioning~~ said valve pin is generally positioned in alignment with said gate ~~during movement of said valve pin towards said gate~~.

Claim 5 (original): An injection molding apparatus as claimed in claim 1, wherein said nozzle tip is retained in said nozzle body by said seal piece.

Claim 6 (original): An injection molding apparatus as claimed in claim 1, wherein said nozzle tip is connected to said nozzle body by a threaded connection.

Claim 7 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said seal piece is a first seal piece, and said nozzle further includes a second seal piece disposed between said first seal piece and said nozzle tip such that said first seal piece, said second seal piece, said nozzle body and said nozzle tip define an insulating airspace.

Claim 8 (original): An injection molding apparatus as claimed in claim 1, wherein said first guidance and alignment structure is removably connected to said valve pin.

Claim 9 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said second guidance and alignment structure is removably connected to said mold block.

Claim 10 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said second guidance and alignment structure is positioned in a gate insert that contains said gate and is removably connected to said mold block.

Claim 11 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said first guide surface curves gradually into said first alignment surface.

Claim 12 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said second guide surface curves gradually into said second alignment surface.

Claim 13 (previously presented): An injection molding apparatus as claimed in claim 1, wherein said gate and said second guidance and alignment structure are defined in a gate insert that is removably connected to said nozzle body.

Claim 14 (currently amended): An injection molding apparatus as claimed in claim 1, wherein said manifold has an inlet and a plurality of said manifold outlets, and has a plurality of ~~said~~ runners downstream from said inlet and upstream from said plurality of manifold outlets, and wherein said injection molding apparatus includes a plurality of said nozzles, wherein each nozzle is downstream from one of said plurality of manifold outlets, wherein said mold block defines ~~a plurality of said mold cavities and defines a~~ plurality of ~~said gates into said plurality of said mold cavities~~, and wherein said mold

block, ~~and~~ said nozzle tip and said seal piece on each of said plurality of nozzles ~~nozzle~~ define ~~one~~ said chamber, and wherein ~~said injection molding apparatus~~ each of said plurality of nozzles includes ~~one~~ said valve pin ~~for each gate and one first guidance and alignment structure for each valve pin and one second guidance and alignment structure for each gate.~~

Claim 15 (currently amended): An injection molding apparatus comprising:

a nozzle body having a melt channel, said nozzle body being made of a first material;

a valve pin at least partially positioned in the melt channel, said valve pin having a first guidance and alignment structure thereon;

a nozzle tip in thermal contact with the nozzle body;

a seal piece in thermal contact with the nozzle tip and the nozzle body; and

a mold gate insert having a gate, said mold gate insert being in contact with the seal piece;

wherein[[,]] the nozzle tip is made of a second material having a higher thermal conductivity than said first material,

wherein the seal piece is made of a third material having a lower thermal conductivity than said first material,

wherein the mold gate insert is made of a fourth material having a higher thermal conductivity than said third material, and

wherein the mold gate insert includes a second guidance and alignment structure that contacts the first guidance and alignment structure before the valve pin ~~contact~~ contacts the gate during movement of said valve pin towards said gate.

Claim 16 (previously presented): An injection molding apparatus as claimed in claim 15, wherein the nozzle tip has a nozzle tip guidance and alignment structure that contacts the first guidance and alignment during movement of the valve pin towards the gate orifice.

Claim 17 (previously presented): An injection molding apparatus as claimed in claim 15, wherein the nozzle tip is threaded to the nozzle body.

Claim 18 (previously presented): An injection molding apparatus as claimed in claim 15, wherein the seal piece is threaded to the nozzle body.

Claim 19 (previously presented): An injection molding apparatus as claimed in claim 15, wherein the seal piece retains the nozzle tip.

Claim 20 (previously presented): An injection molding apparatus as claimed in claim 15, wherein the first guidance and alignment structure of the valve pin is removably connected to said valve pin.

Claim 21 (previously presented): An injection molding apparatus as claimed in claim 15, wherein said gate insert is removably connected to said nozzle body.

Claim 22 (cancelled).

Claim 23 (previously presented): An injection molding apparatus as claimed in claim 1, wherein the thermal conductivity of said nozzle tip is higher than the thermal conductivity of said nozzle body, and wherein the thermal conductivity of said seal piece is lower than the thermal conductivity of said nozzle body.

Claim 24 (currently amended): An injection molding apparatus comprising:

a nozzle body having a melt channel;

a valve pin ~~at least partially positioned in the melt channel, said valve pin~~

including a first guidance and alignment structure, a second guidance and alignment structure downstream from said first guidance and alignment structure and a first sealing surface downstream from said second guidance and alignment structure;

a nozzle tip in thermal contact with the nozzle body and including a third guidance and alignment structure;

a seal piece in thermal contact with the nozzle tip and the nozzle body; and

a mold plate defining ~~a mold cavity and a gate into said mold cavity~~, wherein said mold plate includes a fourth guidance and alignment structure and a second sealing surface downstream from said fourth guidance and alignment structure;

wherein said first guidance and alignment structure of said valve pin is capable of interacting with said third guidance and alignment structure of said nozzle tip and said second guidance and alignment structure of said valve pin is capable of interacting with said fourth guidance and alignment structure of said mold plate, wherein ~~so that~~ said first sealing surface contacts said second sealing surface without contacting any other surfaces of said nozzle tip or said mold plate.

Claim 25 (currently amended): The injection molding apparatus of claim 24, wherein said mold plate includes a gate insert, ~~wherein said gate insert defines~~ defining said gate, said fourth guidance and alignment structure ~~[[,]]~~ and said sealing surface ~~and at least a portion of said mold cavity~~.

Claim 26 (previously presented): The injection molding apparatus of claim 25, wherein said gate insert contacts said seal piece.

Claim 27 (previously presented): The injection molding apparatus of claim 25, wherein said gate insert is in thermal contact with said nozzle body.

Claim 28 (previously presented): The injection molding apparatus of claim 25, wherein said seal piece is a first material and said gate insert is a second material having a higher thermal conductivity than said first material.

Claim 29 (previously presented): The injection molding apparatus of claim 24, wherein said seal piece is a first material, said nozzle body is a second material having a thermal conductivity that is higher than said second material, and said nozzle tip is a third material having a higher thermal conductivity than said second material.

Claim 30 (new): The injection molding apparatus of claim 1, wherein one of said seal piece and said nozzle tip is removably connected to said nozzle body.

Claim 31 (new): The injection molding apparatus of claim 1, wherein said mold block includes a gate insert defining said gate.

Claim 32 (new): The injection molding apparatus of claim 31, wherein said chamber is defined by said mold block, said gate insert, said nozzle tip and said seal piece.

Claim 33 (new): The injection molding apparatus of claim 15, wherein said nozzle tip is in guiding contact with said valve pin during movement of said valve pin towards said gate.

Claim 34 (new): An injection molding apparatus, comprising:

a manifold having a manifold outlet;

a nozzle defining a nozzle melt channel downstream from said manifold outlet, wherein said nozzle includes a nozzle body, a nozzle tip, and a seal piece, wherein said nozzle tip is removable from said nozzle body and wherein said nozzle tip defines a portion of said nozzle melt channel;

a mold block including a gate insert that defines a gate downstream from said nozzle melt channel and includes a gate sealing surface, wherein said seal piece and said gate insert engage said mold block within a common bore in said mold block; and

a valve pin having a valve pin sealing surface engageable with said gate sealing surface.

Claim 35 (new): The injection molding apparatus of claim 34, wherein said valve pin has a first guidance and alignment structure upstream from said valve pin sealing surface including a first guide surface and a first alignment surface, wherein said first guide surface has a cross-sectional diameter that decreases gradually in a downstream direction, and wherein said first alignment surface is generally cylindrical and said first guide surface is positioned immediately downstream from said first alignment surface; and

said mold block has a second guidance and alignment structure upstream from said gate sealing surface including a second guide surface and a second alignment surface, wherein said second guide surface has a diameter that decreases gradually in a downstream direction, and wherein said second alignment surface is generally cylindrical and said second guide surface is positioned immediately upstream from said second

alignment surface,

wherein, during movement of said valve pin towards said gate, said second guide surface engages said first guide surface, said first alignment surface slides into alignment with said second alignment surface, said first alignment surface slides along said second alignment surface and said valve pin sealing surface is positioned in alignment with said gate sealing surface.

Claim 36 (new): An injection molding apparatus as claimed in claim 35, wherein:

said valve pin has a third guidance and alignment structure upstream from said first guidance and alignment structure including a third guide surface and a third alignment surface, wherein said third guide surface has a cross-sectional diameter that decreases gradually in a downstream direction, and wherein said third alignment surface is generally cylindrical and said third guide surface is positioned immediately downstream from said third alignment surface and is upstream from said first alignment surface; and

said nozzle tip has a fourth guidance and alignment structure including a fourth guide surface and a fourth alignment surface, wherein said fourth guide surface has a diameter that decreases gradually in a downstream direction, and wherein said fourth alignment surface is generally cylindrical and said fourth guide surface is positioned immediately upstream from said fourth alignment surface and said fourth alignment surface is upstream from said second guide surface,

wherein, during movement of said valve pin towards said gate, said fourth guide surface engages said third guide surface, said third alignment surface slides into alignment with said fourth alignment surface, said third alignment surface slides along

said fourth alignment surface and said valve pin is generally positioned in alignment with said gate.

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